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# **Objective Versus Subjective Military Pilot Selection Methods in the United States of America**



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## 1.0 SUMMARY

In the U.S. Air Force, pilots are chosen through varying processes. Although these pilot selection methods share similarities, Air National Guard (ANG) has a more subjective selection process than active duty (AD). To compare, 1,801 ANG and 11,616 AD pilot applicants were administered a computer-based intelligence test, the Multidimensional Aptitude Battery-II , and a personality measure, the NEO Personality Inventory-Revised. Both groups shared similar personality traits characterized by emotional stability, extraversion, and high work ethic. Intelligence scores were near the superior range for ANG and AD pilots. Although chosen by diverse methods, both ANG and AD pilots shared similar cognitive and personality characteristics.

## 2.0 INTRODUCTION

There is a tradition in military aviation of attempting to select only those candidates with the “right stuff,” often defined as high intelligence, emotional maturity, achievement-orientation, good interpersonal skills, and strong motivation to fly [1]. During the infancy of aviation, however, standards were evolving and little regard was paid to an aviator’s intelligence or personality characteristics. Standards that were used focused on screening out undesirable medical conditions, as many early aviators were killed due to physical defects. In response, flight surgeons began to impose more stringent medical standards for flyers.

Mental health was not widely considered in screening applicants until the 1920s. This change occurred after the British found that up to 50% of pilot candidates during World War I developed a neurosis (i.e., mental health disorder) prior to graduating flight training [2]. This training pipeline was both costly and inefficient, and flight surgeons began to consider intellectual and personality characteristics of pilots with more zeal. In 1928, Rhoades, a U.S. Navy flight surgeon, developed personality classes for aviators. He designed a series of contrasting traits to distinguish above-average versus below-average pilot applicants. For example, he preferred an “intelligent” versus “stupid” candidate and one who was “precise” rather than “vague.” He also described personality characteristics that he perceived to be more adaptive in the aviator environment. These traits included cheerfulness, aggressiveness, and attentiveness [3]. In 1930, another flight surgeon, Longacre, also attempted to describe favorable traits. From his perspective, the ideal pilot would be young, single, medically healthy, educated, dextrous, emotionally stable, self-reliant, intelligent, and highly motivated [4]. In assessing for intelligence and personality characteristics, flight surgeons were attempting a more holistic selection process, i.e., they were looking for not just the absence of medical or mental health problems, but were also interested in finding pilots who exhibited healthy, adaptive characteristics that would enable them to succeed in the demanding career field of military aviation. Among American military branches, the U.S. Air Force (USAF) contains the majority of pilots and continues to attempt to select pilots who are not just medically healthy but also intelligent, emotionally resilient, and highly motivated to fly.

Within the USAF, there are multiple avenues to become a pilot. One major dividing line is between active duty (AD) and Air National Guard (ANG) pilots; AD pilots are chosen primarily from USAF Academy cadets and Reserve Officer Training Corps (ROTC) cadets. Although there are minor differences between the selection techniques of the USAF Academy and ROTC, they are generally very similar in their approach. The ANG, however, utilizes a

much more diverse, subjective method of selecting pilots for aircraft. This is not surprising, given the ANG is organized into individual units located in each of the 50 states, U.S. territories, and Washington, DC. Unlike AD forces who have one Commander-in-Chief (the President), ANG units are controlled by state governors. Another important difference is that ANG pilots are chosen for a particular airframe that is flown by their individual unit, whereas AD pilots compete to be a top pilot in training to earn their choice of aircraft. This paper will discuss similarities and differences between ROTC and ANG selection processes and compare the intellectual and personality characteristics of the pilots who are deemed to have the “right stuff.”

ROTC chooses pilots through the process of a selection board that uses standardized criteria. This board judges among the applicants using multiple standardized domains. The most heavily weighted domain is the applicant’s Pilot Candidate Selection Method (PCSM) composite score. Carretta found the PCSM composite score was moderately correlated with completion of T-6 training in USAF pilots [5]. The PCSM score is composed of three measurements. The first is the applicant’s Test of Basic Aviation Skills score. The Test of Basic Aviation Skills is a computerized test designed to assess pilot skills by measuring spatial orientation and psychomotor skills and multitasking. The second is the applicant’s Air Force Officer Qualifying Test score. This is a paper and pencil cognitive test given to all officers. The final measure that makes up the PCSM score is the total number of flying hours the applicant has accomplished. Four additional domains are used to judge an applicant’s suitability to become a pilot. The first is based on an applicant’s performance during field training exercises. The second is the applicant’s performance during a physical fitness assessment. Thirdly, the applicant’s college grade point average is used to rank the pilot applicant. Finally, a commander’s ranking is added to the equation. The commander’s ranking is based on his or her judgment of the applicant’s potential using a “whole person” concept. All of these factors are taken into account when judging the suitability of an ROTC pilot.

In contrast, the ANG’s selection process is not centralized. This allows for units throughout the states with different missions to tailor their selection process to their individual needs. Like ROTC, ANG pilot applicants are reviewed by a selection board. The standards that ANG selection boards use to select pilots vary by state and can even differ within states based on a commander’s discretion. Like ROTC selections boards, ANG boards will often use the PCSM score as a differentiator among applicants. Some ANG units will have a minimum cut-off PCSM score, while others will have less formalized standards. Some ANG boards will take into consideration prior work history, motivation to fly, previous accomplishments, and officership (i.e., leadership). A key difference between the ROTC and ANG selection process is that ANG will often attempt to hire from within its ranks. Enlisted members, who often are already in flying positions (e.g., loadmaster) and have shown good leadership potential, are often encouraged to apply for pilot positions. The ANG has a distinct advantage over ROTC in that its leadership will often be able to observe the performance of its members over a span of years prior to selecting them for a pilot slot.

### **3.0 METHODS**

Data were collected on AD and ANG pilots through the Military Flight Screening-Neuropsychiatry process, which is baseline cognitive and personality testing administered as part of the initial flight physical examination. This testing is not a selection instrument but a clinical tool that can be used at a later date if, for example, the aviator sustains a traumatic brain injury.



A computer-based test of general intellectual ability, the Multidimensional Aptitude Battery-II (MAB-II), and a personality measure, the NEO Personality Inventory-Revised (NEO PI-R), were administered to 11,616 ROTC and 1,801 ANG pilot applicants. The MAB-II is derived from the Wechsler Adult Intelligence Scale-Revised and is composed of 10 subtests. The five verbal subtests include information, comprehension, arithmetic, similarities, and vocabulary. The five performance subtests include digit symbol, picture completion, spatial, picture arrangement, and object assembly. These subtests yield three composite scores: verbal intelligence, performance intelligence, and full-scale intelligence (FSIQ). For composite scores, internal consistency (.94 to .98) and test-retest reliability (.92-.95) are reportedly high [6].

The NEO PI-R is a 240-item computer instrument that measures five major domains of personality [7]. These include neuroticism, extraversion, openness, agreeableness, and conscientiousness. The NEO-PI-R also gives six underlying facets for each domain. Strong evidence has been demonstrated for content, criterion, and construct validity. Internal consistency (.89 to .93) and test-retest reliability (.91 to .93) have been shown to be high for domain scores.

The mean age for ANG pilots was 26 (standard deviation (SD)=2.13), while the mean age for ROTC pilots was 22.97 (SD=2.14). Of ROTC pilots, 90.3% identified as Caucasian, 3.5% identified as Hispanic, 2.95% identified as Asian/Pacific Islander, 1.5% identified as Other, 1.3% identified as African-American, 0.4% identified as Indian American, and 0.1% identified as Arabic. Demographic data for ANG pilots were not obtained, but King and colleagues reported that in a large sample of all USAF pilots, 84.2% identified as White, 4.0% identified as Hispanic, 9.4% identified as Other, and 2.4% identified as African-American [8]. For ANG pilots, 92.6% were males, while 93.5% of ROTC pilots were males.

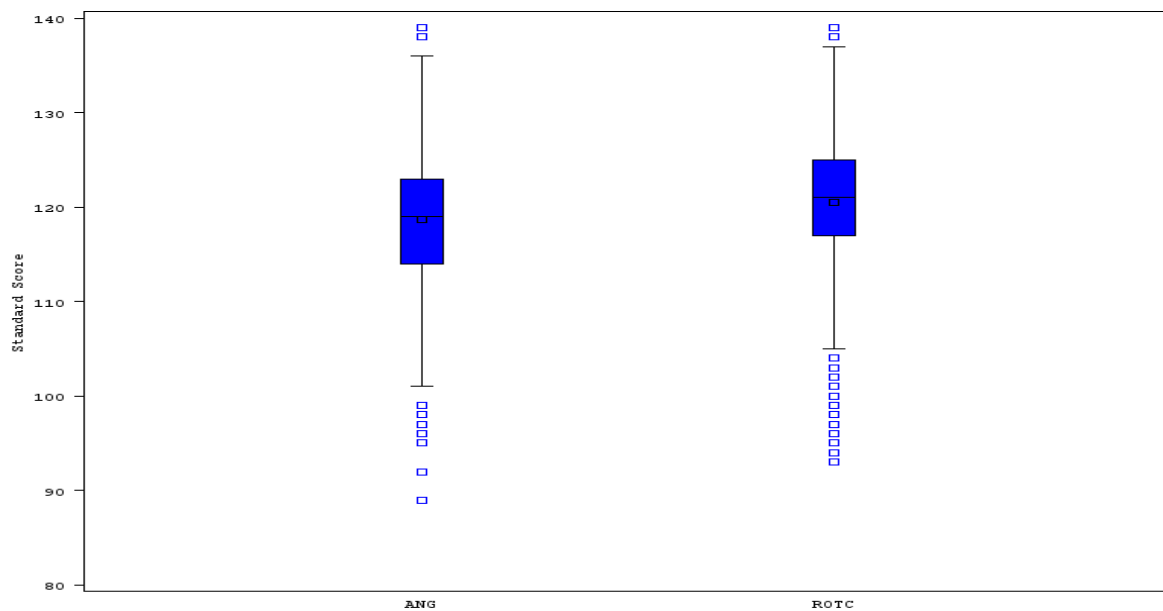
## 4.0 RESULTS

Compared to the general population (Table 1), the mean score for FSIQ on the MAB-II in ANG pilots was at the 90<sup>th</sup> percentile (mean (M)=118.7, SD=6.67), while ROTC pilots had a mean FSIQ at the 92<sup>nd</sup> percentile (M=120.5, SD=6.32). ROTC intelligence scores were significantly different ( $p<.01$ ) than ANG intelligence scores (higher ROTC scores), with an effect size of 0.28 (Cohen's  $d$ ). Figure 1 shows essentially all USAF pilots are above the general population mean of 100.

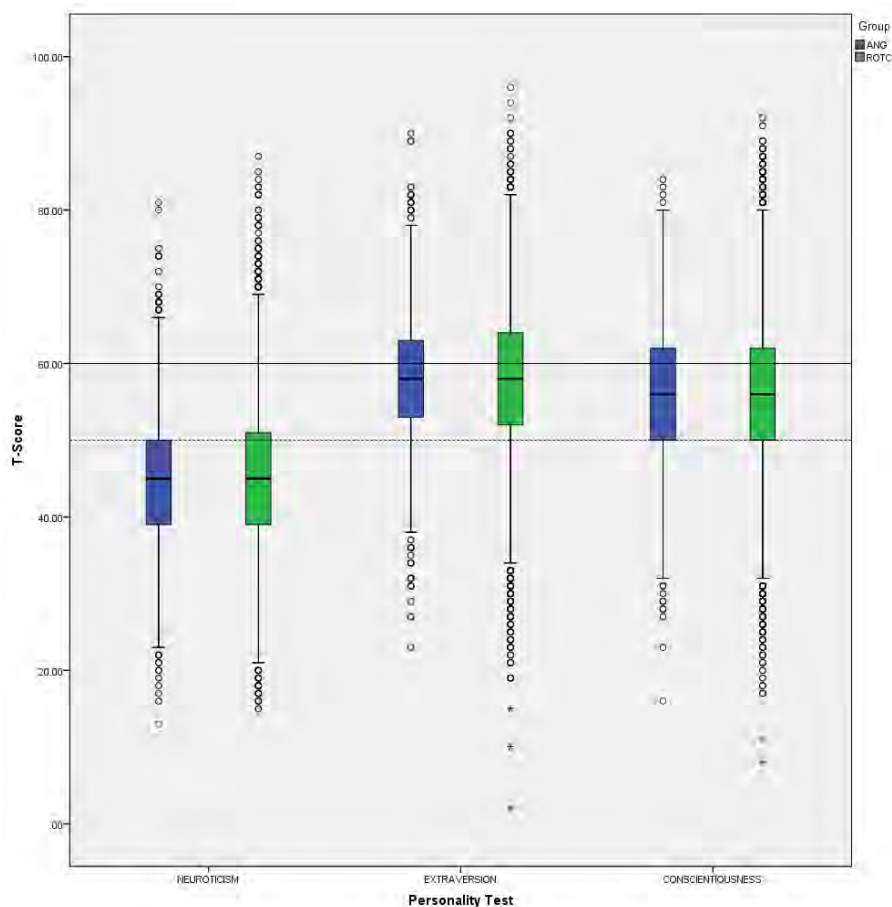
Similarities between ANG and ROTC pilots were also found on personality domains (Figure 2). Both ANG pilots (M=44.64, SD=9.09) and ROTC pilots (M=45.27, SD=9.37) were below the general population in susceptibility to emotional distress (neuroticism). Additionally, ANG and ROTC pilots were higher than the general population in conscientiousness (M=55.85, SD=8.73 and M=55.78, SD=9.88) and extraversion (M=58.01, SD=8.72 and M=57.94, SD=9.54), respectively. Significant differences between ANG and ROTC pilots were not found for the domains of extraversion and conscientiousness. However, ANG pilots were significantly different ( $p=.01$ ) on the domain of neuroticism (lower ANG scores), with a minimal effect size of .07 (Cohen's  $d$ ).

**Table 1. FSIQ and Personality Scores of ANG Pilots, ROTC Pilots, and Civilians**

Domain/Facet	ANG			ROTC			Civilian Sample		ANG vs. ROTC		
	N	Mean	SD	N	Mean	SD	Mean	SD	t value	Two-Sided p-value	Cohen's d Effect Size
<b>FSIQ</b>	1,801	118.7	6.7	11,616	120.5	6.3	100.0	15.0	11.29	<0.01	0.28
<b>Neuroticism</b>	1,801	44.6	9.1	11,616	45.3	9.4	50.0	10.0	2.67	0.01	0.07
<b>Extraversion</b>	1,801	58.0	8.7	11,616	57.9	9.5	50.0	10.0	0.29	0.77	0.01
<b>Conscientiousness</b>	1,801	55.8	8.7	11,616	55.9	9.9	50.0	10.0	0.28	0.78	0.00



**Figure 1. Box plot of ANG and ROTC FSIQ scores.**



**Figure 2. Box plot of ANG and ROTC personality traits.**

## 5.0 DISCUSSION

Although ANG pilots are selected using a less standardized and more subjective method than their AD counterparts, both processes produce pilots with favorable characteristics for success in the aviation career field. Superior intelligence has been associated with success in multiple career fields [9,10] and has long been considered an important part of the selection process for pilots. The mean FSIQ of both groups of pilots is well above the general population mean, and although ROTC pilots had a significantly higher intelligence score, the difference is not thought to be meaningful. Whether or not it is necessary to have superior intelligence to succeed as a military pilot is unclear, but anecdotally, pilots with intelligence well below their peers (i.e., greater than two standard deviations) have reported academic difficulty in Undergraduate Pilot Training. This may suggest that above-average intelligence is an important aspect of making the ideal pilot, but that motivation and character traits, to include neuroticism, extraversion, and conscientiousness, also make substantial contributions.

Multiple studies examining the role of neuroticism, extraversion, and conscientiousness in military or other dangerous occupations have concluded that these characteristics play an important role in mission success [11,12]. ANG and AD pilots are low in the character trait of neuroticism. People low in neuroticism are often described as resilient and emotionally stable. These characteristics allow ANG and AD pilots to remain calm and steady when encountering stressful situations during military flying. The trait also aids them in juggling the demands of work and home life, and there is evidence that USAF pilots have much lower rates of depressive disorders [13] and anxiety [14] than the general public. The ability to compartmentalize, or focus on the present moment, is key in dealing with the stressors of military life.

Interpersonal skills play a role in every occupation and are known to be an important characteristic of successful pilots. Another key characteristic for successful pilots is their above-average level of extraversion. Extraversion is a combination of interpersonal warmth, gregariousness, assertiveness, energy level, and openness to positive emotions. Crew resource management is a component of mission success for the pilot, and higher levels of extraversion allow ANG and AD pilots to navigate interpersonal relationships with both crew and staff while also communicating accurately and decisively during combat missions.

Finally, USAF pilots are above-average in the trait of conscientiousness. Siem & Murray found that conscientiousness was the most important personality factor associated with pilot success [15]. Conscientious individuals are achievement oriented and often have a strong desire to succeed in activities in which they are engaged. Pilots tend to be organized, dependable, and reliable. These are traits employers often covet in employees, as they are associated with achievement at work. Pilots who are given the reins of weapons systems costing tens of millions of dollars are expected to be trustworthy and competent, and they are typically more conscientious than their general population peers.

## **6.0 CONCLUSION**

Although ANG pilots are chosen by a more subjective, less structured process than AD pilots, both groups have similar characteristics of high intelligence, hardiness, extraversion, and conscientiousness that are associated with success in the aviation environment.

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## **LIST OF ABBREVIATIONS AND ACRONYMS**

<b>AD</b>	active duty
<b>ANG</b>	Air National Guard
<b>FSIQ</b>	full-scale intelligence
<b>M</b>	mean
<b>MAB-II</b>	Multidimensional Aptitude Battery-II
<b>NEO PI-R</b>	NEO Personality Inventory-Revised
<b>PCSM</b>	Pilot Candidate Selection Method
<b>ROTC</b>	Reserve Officer Training Corps
<b>SD</b>	standard deviation
<b>USAF</b>	U.S. Air Force